

## Glenn Research Center, Environmental Programs Manual

### Chapter 35 - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATED MATERIALS PROGRAM

**NOTE:** The current version of this Chapter is maintained and approved by the Environmental Management Office (EMO). This chapter was last revised June 2004. If you are referencing paper copies, please verify that it is the most current version before use. The current version is maintained on the Glenn Research Center (GRC) Intranet at <http://osat-ext.grc.nasa.gov/emo/pub/epm/epm-contents.pdf>. Approved by: EMO Chief, Michael Blotzer {mailto:Michael.J.Blotzer@grc.nasa.gov}

#### PURPOSE

The purpose of the OSHA Regulated Materials compliance program is to protect all employees who may be exposed to regulated chemicals from adverse health effects. This program establishes minimum requirements for handling, use, and disposal of all regulated materials at the Glenn Research Center and Plum Brook Station, with the exception of asbestos, mercury and lead, which have separate programs.

#### APPLICABILITY

This policy is applicable to all personnel at the Glenn Research Center and Plum Brook Station, including, but not limited to, civil servants, contractor personnel (construction contract personnel must comply with the contents of this program; however, the contractor is responsible for implementation details such as air monitoring and personal protection equipment) and students.

#### DEFINITIONS

8-hour TWA – Time weighted average concentration to which an employee is exposed over an 8-hour day.

Action Level – This is the concentration or level of an agent at which it is deemed that some specific action should be taken. The action can range from monitoring the exposure on a routine basis to making engineering adjustments. In general the action level is set at one half of the adopted occupational exposure limit.

American Conference of Governmental Industrial Hygienists (ACGIH) – Professional society made up of government employed industrial hygienists as well as industrial hygienists from the private sector. The ACGIH is devoted to administrative and technical aspects of occupational and environmental health.

Carcinogen – A substance or agent capable of causing or producing cancer in mammals, including humans. A chemical is considered to be a carcinogen or potential carcinogen if; a) it has been evaluated by IARC and found to be a carcinogen or potential carcinogen; b) it is listed as a carcinogen or potential carcinogen in the annual report on carcinogens published by the National Toxicology Program (NTP); or c) it is regulated by NIOSH or OSHA as a carcinogen.

Disposal – Final placement for destruction of toxic, radioactive or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from remedial actions or accidental releases. Disposal may be accomplished through use of approved secure landfills, surface impoundments, land farming, incineration, etc.

Engineering Controls – Designing out the hazard by process changes, substitution of harmful materials, isolation, ventilation, and source modification.

Excursion Limits – Are criteria for substances that have 8-hour TLV-TWA but no TWA-STEL or TLV-C, due to the lack of sufficient toxicological data. These limits are based on the maximum concentration above the established 8-hour TLV-TWA, which short-term exposure events can occur during the working day without exceeding the accepted occupational exposure limit. Excursions in a worker exposure levels may exceed 3 times the TLV-TWA for no more than 30 minutes during the workday, and under no circumstances should they exceed 5 times the TLV-TWA, provided that the 8-hour TLV-TWA is not exceeded.

Occupational Exposure Limit (OEL) – A health-based workplace standard to protect workers from adverse exposure (e.g., PELs, TLVs, WEELs, etc.).

**Permissible Exposure Limit (PEL)** – The OEL established by OSHA, The permissible concentration in air of a substance to which nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, for 30 years without adverse effects.

**Possibly Carcinogenic to Humans** – Chemical agents, mixtures, and exposure circumstances for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals.

**Recommended Exposure Limit (REL)** – The recommended exposure limit for a substance in air established and published by the National Institute for Occupational Safety and Health (NIOSH).

**Sensitizer** – A material that is capable of causing an immune response in an individual. In most cases, initial exposure results in a normal response, but repeated exposures lead to progressively strong and abnormal responses.

**Skin Notation** – Denotes the possibility that dermal absorption may be a significant contribution to the overall body burden of the chemical (that is, the airborne OEL may not be adequate to protect the worker because the compound also readily penetrates the skin. Other reactions to the skin such as irritation, dermatitis, and sensitization are not sufficient to warrant the skin notation.

**Systemic Effect** – Adverse affect that occurs at a site other than at the site of contact.

**Standard Operating Procedure (SOP)** – A written document that details an operation, analysis, or action whose mechanisms are thoroughly prescribed and that is commonly accepted as a method for performing certain routine or repetitive tasks.

**Suspect Human Carcinogen** – Human data are accepted as adequate in quality but are conflicting or insufficient to classify the agent as a confirmed human carcinogen; or, the agent is carcinogenic in experimental animals at dose(s), by route(s) of exposure, at site(s), of histologic type(s), or by mechanism(s) considered relevant to worker exposure. This classification is used primarily when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals with relevance to humans.

**Target Organs** – 1.) The organ of the body most affected by exposure to a particular substance. 2.) The body organs that are affected by exposure to a hazardous chemical, physical, or biological agent.

**Threshold Limit Value (TLV)** – Established by the American Conference of Governmental Industrial Hygienist (ACGIH) to designate degree of exposure to contaminants and expressed as parts of vapor or gas per million parts of air by volume at 25°C and 760 mmHg pressure, as approximate milligrams of particles per cubic meter of air (mg/m<sup>3</sup>) or as number of fibers per cubic centimeter of air (f/cc). An exposure level under which it is believed most people can work consistently for 8 hours a day, day after day, with no harmful effects.

**Threshold Limit Value – Time Weighted Average (TLV-TWA)** – The time-weighted average concentration for a normal 8 hour workday and a 40 hour workweek to which nearly all workers may be exposed repeatedly, day after day, without adverse effects.

**Threshold Limit Value – Ceiling (TLV-C)** – The concentration, of a contaminant, that should not be exceeded at any time.

**Threshold Limit Value – Short-Term Exposure Limit (TLV-STEL)** – A 15-minute TWA exposure that is not to be exceeded at any time during a workday even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes, must not occur more than 4 times per day, and there should be at least 60 minutes between successive exposures in this range.

**Time Weighted Average Exposure** – Average concentration of an agent over a given working period of a person's exposure, as determined by sampling.

**Toxicity** – A relative property of a chemical agent that refers to harmful effects on some biologic mechanism and the conditions under which the effect occur

**Toxicology** – Scientific study of poisons, their actions, their detection, and treatment of conditions produced by them.

**Toxicologic Effect** – Harmful or poisonous effect of a chemical agent.

## BACKGROUND

The Occupational Safety and Health Administration have issued compliance standards for a number of chemicals. Each standard has specific requirements for assessing and controlling exposures to employees. These may or may not include exposure monitoring of employees for each job classification, establishment of regulated areas with specific warning signs and handling procedures, mandatory engineering controls, specific work practices, respiratory protection, written programs and written standard operating procedures. In addition, GRC may determine additional requirements based upon the chemical, its hazards, and the results of a hazard assessment and exposure monitoring.

The Environmental Management Office (EMO) recognizes that OSHA regulated materials are generally used in small quantities and on an infrequent basis at NASA GRC. Therefore, in order to comply with the OSHA standards, EMO has developed the following guidelines for current and future use of all OSHA regulated materials.

## POLICY

It is GRC policy to comply with all applicable regulations regarding chemical use and to prevent illness to workers and damage to the environment from the use, removal and disposal of the chemicals. To accomplish this, all personnel must comply with the requirements of this chapter.

It is also NASA's official policy to adhere to OSHA or the American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits (whichever is more restrictive) to ensure worker protection.

This chapter applies to all OSHA regulated chemicals that are either currently used or that will be used in the future at GRC.

### Regulated Materials Currently Used At GRC

OSHA regulated materials currently used or found at GRC included in this program are the following:

- Benzene
- Cadmium
- Formaldehyde
- Inorganic Arsenic
- 4,4-Methylenedianiline
- Methylene Chloride

Specific requirements for the handling and use of the materials can be found in the appendices of this document.

OSHA regulated materials not currently used or found at GRC included in this program are the following:

- 2-Acetylaminofluorene
- Acrylonitrile
- 4-Aminodiphenyl
- Benzidine
- 1,3-Butadiene
- bis-Chloromethyl ether
- Coal Tar Pitch Volatiles
- Coke Oven Emissions
- Cotton Dust
- 1,2,-dibromo-3-chloropropane
- 3,3 -Dichlorobenzidine (and its salts)
- 4-Dimethylaminoazobenzene
- Ethyleneimine
- Ethylene Oxide
- Methyl chloromethyl ether
- alpha-Naphthylamine
- beta-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- beta-Propiolactone
- Vinyl Chloride

## REQUIREMENTS

### Use of Current Materials

The IHT must be kept apprised of OSHA regulated material use throughout the lab. The IHT must be notified by the area supervisor when a process, which uses a regulated material, changes, or when new tasks not previously assessed require the use of a regulated material. The Chemical Management Team in the Environmental Management Office will notify the Industrial Hygiene Team when an OSHA regulated material or a product containing an OSHA regulated material is being requested. This information shall be provided to Industrial Hygiene Team at 3-3030 in a timely manner in order to arrange for hazard assessments and not delay the user's work.

### Hazard Assessment

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Results of the hazard assessments for all current users of a given material will enable the IHT to determine if a written program must be established or revised. Written programs will be included in this chapter as appendices.

A hazard assessment will be performed by the Industrial Hygiene Team when:

- An OSHA regulated chemical is being requested for purchase
- A process which uses a regulated material changes
- A new task not previously assessed requires the use of a regulated material

Hazard assessments will include:

- A review of related standards to determine regulatory requirements.
- A meeting with the requester to discuss usage, handling procedures, possible engineering controls, personal protective equipment and scheduling of exposure monitoring

Environmental Compliance Team (ECT)

- Provides guidance on the requirements of Federal, State and local environmental regulations.
- Provides guidance for handling spill situations. (See [Chapter 8](#) for details).
- Assists in the collection and disposal of regulated materials and waste products containing regulated materials.

Waste Management Team (WMT)

- Collects and disposes of regulated waste.

Industrial Hygiene Team (IHT)

- Provides guidance on the requirements of Federal, State and local occupational health regulations.
- Maintains the OSHA Regulated Materials Program.
- Performs Exposure Assessments
- Recommends procedures to minimize exposure
- Recommends employees for inclusion in a medical surveillance program, if required.
- Maintains the task and exposure database for all related operations.
- Conducts any required training beyond that provided under the Hazard Communication Standard

Chemical Management Team (CMT)

- Maintains the chemical inventory
- Reviews chemical purchases and notifies the IHT when OSHA regulated materials or products containing OSHA-regulated materials are requested
- Controls and approves use of cadmium-containing brazing alloys
- Conducts Hazard Communication training

Occupational Medical Services

- Maintains medical surveillance programs for civil servant and contractor employees exposed to regulated chemicals that require medical monitoring.

#### Plum Brook Station Management Office (PBMO)

- Identifies OSHA Regulated Materials at Plum Brook Station and develops an OSHA Regulated Materials compliance program based upon the Occupational Health and Safety Standards in 29 CFR Part 1910.

#### Supervisors

- Identify users of regulated materials within the guidelines of this policy and notify the Industrial Hygiene Team of the user and the particular material prior to its use.
- Ensure regulated areas are properly marked and access is restricted.
- Ensure employees follow good work practices
- Ensure employees meet training requirements

#### Employees

- Procure chemicals in compliance with [Chapter 22](#) “Acquisition of Hazardous Chemicals and Materials” of the Environmental Programs Manual
- Use the regulated materials in accordance with procedures established for safe use of the materials.
- Use personal protective equipment as specified in established work procedures.
- Notify medical services and their supervisor if they experience any signs or symptoms of over-exposure.
- Notify their supervisors of any operational changes or new uses of the regulated materials.
- Discard waste material through the Waste Management Team
- Attend training when required

### PROCEDURES

Refer to flow chart for OSHA Regulated Chemicals

### RECORDS

- Exposure Assessment (Maintained by IHT)
- Exposure Assessment Database (Maintained by IHT)
- OSHA Regulated Chemicals Database (Maintained by IHT)
- Medical Examinations (Maintained by Occupational Medical Services (OMS))
- Chemical Inventory (Maintained by CMT)

### REFERENCES

- U.S. Department of Labor, Occupational safety and Health Administration, 29 CFR Part 1910 Subpart Z – Toxic and Hazardous Substances.
- American Conference of Governmental Industrial Hygienists TLV's and BEI's (most recent edition).

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## **Appendix A – Inorganic Arsenic**

### **BACKGROUND**

Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic can also affect the body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. This does not include arsine.

The inorganic arsenic PEL-TWA is  $10 \mu\text{g}/\text{m}^3$  and the action level (AL) is  $5 \mu\text{g}/\text{m}^3$ . The NASA GRC OEL for arsenic is the same. Compliance with this limit is primarily achieved through chemical substitution. When arsenic must be used, engineering and work practice controls combined with personal protective equipment are used to minimize exposure.

### **ARSENIC COMPLIANCE PROGRAM PROCEDURES**

This section describes the general procedures to reduce and control exposure to arsenic.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine employee exposure. In some instances, the use of arsenic may not require air monitoring. Examples of this include using arsenic in a form that does not represent an airborne hazard or using it in a closed or controlled environment.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Tasks that require exposure assessments, including personal monitoring, shall be performed whenever a process, requiring the use of a regulated material, changes or when a new task using a regulated material has not been previously assessed.

All analyses of samples will be performed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the initial exposure assessment reveals exposures are below the action level, no further monitoring is required unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures are above the action level but below the TWA-8, air monitoring must be conducted every 6 months.
- If the exposure assessment reveals exposures above the TWA-8, air monitoring must be conducted at least every three months
- Exposure monitoring will continue until 2 consecutive measurements taken at least 7 days apart are below the action level. Exposure monitoring will only need to be continued then if a change has occurred in the process or control.

#### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 5 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded or significant surface contamination is found, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

#### Regulated Areas

Regulated areas will be established when exposure monitoring indicates exposures are above the TWA-8. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to inorganic arsenic. Signs for the regulated area shall read "Danger, Inorganic Arsenic, Cancer Hazard, Authorized Personnel Only, No Smoking or Eating, Respirator Required".

Only authorized, properly trained individuals will be permitted to enter these areas. Cosmetics cannot be applied in a regulated area and food, beverages, smoking and chewing products and gum cannot be used in a regulated area.

Supervisors of the area are responsible for the posting of the signs.

### Exposure Controls

#### Engineering

Due to the hazardous nature of inorganic arsenic and the low permissible exposure level, all operations using inorganic arsenic shall be performed under local exhaust ventilation, unless the supervisor has granted prior approval of the task and the task has been evaluated and approved by the IHT.

#### Respiratory Protection

Respiratory protection shall only be used as an interim control or for emergencies. Respirators shall be used in accordance with the GRC Respiratory Protection Program.

#### Protective Clothing

GRC shall provide protective clothing that prevents contamination of the employee's garments and dermal contact to employees using inorganic arsenic. This includes but is not limited to:

- work clothing such as aprons, lab coats and smocks
- equipment including appropriate gloves and safety glasses

All contaminated protective clothing shall be placed in a covered container.

### Work Practices

Supervisors shall be responsible for ensuring that all employees follow good hygiene practices while performing tasks involving inorganic arsenic. This includes, but is not limited to, restricting arsenic use to regulated areas, wet wiping hoods and equipment upon completion of a task, disposing of rags properly, not eating, drinking, or applying cosmetics while performing a task, and washing thoroughly upon completion of a task.

All containers storing inorganic arsenic or products containing inorganic arsenic shall be labeled "Danger, Contains Inorganic Arsenic, Cancer Hazard, Harmful if Inhaled or Swallowed, Use Only in Regulated Areas with Adequate Ventilation or Respiratory Protection".

### Housekeeping

All surfaces shall be kept free from accumulation of arsenic-containing powders and liquids. Floors or other surfaces shall not be cleaned with compressed air. Wet wiping of areas or vacuuming with vacuums equipped with a high efficiency particulate air (HEPA) filter shall be performed at the completion of a task. Rags shall be disposed of properly in containers marked clearly "arsenic-containing, hazardous waste". Emptying vacuumed debris shall be performed in an appropriate manner, using proper PPE to minimize employee exposure and the reentry of arsenic dusts into the workplace.

### Medical Surveillance

Any employee subject to exposure above the action level for 30 days or more per year must be enrolled in a medical surveillance program. Any employee exposed in an emergency situation must be provided with medical monitoring.

The medical surveillance program will include initial examinations, annual examinations and emergency examinations and may require biological monitoring. Multiple physician review will be available. Medical removal will be provided when warranted and medical removal protection will be honored in accordance with the OSHA Standard.

### Employee Training

All employees who use inorganic arsenic must receive training at the time of their initial assignment and annually thereafter for employees exposed to arsenic above the action level. Employees shall be informed of the contents of the Inorganic Arsenic OSHA standard as well as this program. The training shall be conducted before assignment to a regulated area and annually thereafter. The training shall include the following:

- The content of 29 CFR 1910.1018 and appendices.
- The specific nature of the tasks that could result in dermal exposures or elevated airborne concentrations.
- The engineering controls and work practices associated with the specific job assignment.

- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects of inorganic arsenic.
- The contents of this compliance plan.
- The employees' rights of access to records under 1910.20.

## REFERENCES

- U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1018 – Inorganic Arsenic



## Appendix B – Benzene

### BACKGROUND

Exposure to high concentrations of benzene can cause breathlessness, irritability, euphoria, giddiness, irritation of the eyes, nose and respiratory tract, headaches, dizziness, nausea and intoxication. Repeated, prolonged exposures to benzene, even at low concentrations, may result in various blood disorders ranging from anemia to leukemia, some of these blood disorders can occur without symptoms.

The OSHA PEL-TWA for benzene is 1 ppm and the PEL-STEL is 5 ppm. The AL is 0.5 ppm for an 8 hour time weighted average. The NASA GRC OEL for benzene is 0.5 ppm for an 8-hour TWA and a 2.5 ppm STEL. Compliance with this limit is primarily achieved through chemical substitution. When benzene must be used, engineering and work practice controls combined with personal protective equipment are used to minimize exposure. This does not apply to the storage, transportation, distribution, dispensing, or use of gasoline, motor fuels, or other fuels containing benzene subsequent to its final discharge from bulk wholesale storage facilities.

### BENZENE COMPLIANCE PROGRAM PROCEDURES

This section describes the general procedures to reduce and control exposure to benzene.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine employee exposure. In some instances, the use of benzene may not require air monitoring. Such an instance would be if the benzene were in a dilute solution that was not going to be aerosolized, it is used in a closed loop system, and all handling is performed within a properly operating exhaust hood.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Tasks that require exposure assessments including personal monitoring shall be performed whenever a process, requiring the use of a regulated material changes or when a new task not previously assessed is conducted.

All analyses of samples will be performed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the initial exposure assessment reveals exposures are below the action level, no further monitoring is required unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures are above the action level but below the TWA-8, air monitoring must be conducted annually.
- If the exposure assessment reveals exposures above the TWA-8, air monitoring must be conducted at least every six months.
- Exposure monitoring can be changed from every 6 months to annually after 2 consecutive measurements taken at least 7 days apart indicate the employee exposure is below the TWA-8 but above the action level. Exposure monitoring will only need to be reinstated to every 6 months then if a change has occurred in the process or control.
- Annual exposure monitoring can be stopped when 2 consecutive measurements taken at least 7 days apart are below the action level. Exposure monitoring will only need to be reinstated then if a change has occurred in the process or control.
- Monitoring shall be performed whenever leaks, spills, ruptures or other breakdowns occur that may lead to employee exposure. Monitoring will continue until exposures return to the level that existed prior to the incident.

### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 15 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

### Regulated Areas

Regulated areas will be established when exposure monitoring indicates exposures are above the TWA-8 or the STEL. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to benzene. Signs for the regulated area shall read "Danger, Benzene, Cancer Hazard, Flammable – No Smoking, Authorized Personnel Only, Respirator Required".

Only authorized, properly trained individuals will be permitted to enter these areas. Supervisors of the area are responsible for posting signs.

### Exposure Controls

#### Engineering

Due to the hazardous nature of benzene and the low permissible exposure level, all operations using benzene shall be performed under local exhaust ventilation, unless the supervisor has granted prior approval of the task and the task has been evaluated by the IHT.

Benzene is highly flammable. It should be stored in tight closed containers in a cool, well-ventilated area. Benzene vapor may form explosive mixtures in air. All sources of ignition must be controlled. Non-sparking tools must be used when opening or closing benzene bottles. Fire extinguishers must be provided and employees must be properly trained on how to use them.

#### Respiratory Protection

Respiratory protection shall only be used as an interim control or for emergencies. Respirators shall be used in accordance with the GRC Respiratory Protection Program.

#### Protective Clothing

GRC shall provide to employees using benzene or products containing benzene protective clothing that prevents contamination of the employee's garments and dermal contact. This includes but is not limited to:

- work clothing such as aprons, lab coats and smocks
- equipment including appropriate gloves and safety glasses

All contaminated protective clothing shall be placed in a covered container.

### Work Practices

Supervisors shall be responsible for ensuring that all employees follow good hygiene practices while performing tasks involving benzene. This includes, but is not limited to, working only in regulated areas, disposing of rags properly, not eating, drinking, or applying cosmetics while performing a task, and washing thoroughly upon completion of a task.

### Medical Surveillance

Medical surveillance is required when:

- An employee is exposed at or above the action level for 30 days or more per year
- An employee is exposed at or above the PEL for 10 or more days a year
- An employee is exposed to over 10 ppm for more than 30 days a year prior to 1987 when employed by the current employer
- An employee is exposed in an emergency situation

The medical surveillance program will include initial examinations, annual examinations and emergency examinations and may require biological monitoring. Multiple physician review will be available. Medical removal will be provided when warranted and medical removal protection will be honored in accordance with the OSHA Standard.

### Employee Training

All employees who use benzene must receive training at the time of their initial assignment and annually thereafter for employees exposed to benzene above the action level. Employees shall be informed of the contents of the Benzene OSHA standard as well as this program. The training shall be conducted before assignment to a regulated area and annually thereafter. The training shall include the following:

- The content of 29 CFR 1910.1028 and appendices.
- The specific nature of the tasks that could result in dermal exposures or elevated airborne concentrations.
- The engineering controls and work practices associated with the specific job assignment.
- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects of MDA.
- The contents of this compliance plan.
- The employees' rights of access to records under 1910.20.

### REFERENCES

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1028 – Benzene

## **Appendix C – Cadmium**

### **BACKGROUND**

Occupational exposure to cadmium occurs through inhalation of fumes and dust or ingestion through contact with cadmium dust. The major source of employee exposure at GRC is fumes emitted from brazing cadmium-containing alloys. Employees exposed to cadmium face a significant risk to their health from lung cancer and serious kidney damage.

Cadmium is much more dangerous by inhalation than by ingestion. High exposures to cadmium that may be immediately dangerous to life or health occur in jobs where workers handle large quantities of cadmium dust or fume, heat cadmium-containing compounds or cadmium-coated surfaces, weld with cadmium-containing alloys, rods and solders, or cut cadmium-containing materials such as bolts.

Severe exposure may occur before symptoms appear. Early symptoms may include mild irritation of the upper respiratory tract, a sensation of constriction of the throat, a metallic taste and/or a cough. A period of 1-10 hours may precede the onset of rapidly progressing shortness of breath, chest pain, and flu-like symptoms that include weakness, fever, headache, chills, sweating and muscular pain. Acute pulmonary edema usually develops within 24 hours and reaches a maximum within three days. If death from asphyxia does not occur, symptoms may resolve within a week.

Long-term (chronic) exposure occurs from repeated exposure to cadmium, even at relatively low concentrations and may result in kidney damage and an increased risk of cancer of the lung and of the prostate.

The OSHA PEL-TWA for cadmium is  $5\mu\text{g}/\text{m}^3$  and includes all cadmium compounds. The AL is  $2.5\mu\text{g}/\text{m}^3$  for an 8 hour TWA. The NASA GRC OE-TWA for cadmium and compounds is  $2\mu\text{g}/\text{m}^3$  for respirable cadmium dust or fume. Compliance with this limit is primarily achieved through engineering and work practice controls combined with personal protective equipment. The standard requires air monitoring, biological monitoring, medical examinations, written programs, good hygiene practices, training, and record keeping.

### **POLICY**

Cadmium-related tasks at GRC are restricted to silver brazing, welding of cadmium-plated bolts, and nickel-cadmium battery research. Cadmium-related tasks must be performed within a controlled area using engineering and work practice controls that minimize worker exposure and prevent contamination of surrounding areas. The areas must be posted with signs meeting OSHA requirements to restrict access to employees wearing the required personal protective equipment. Regulations governing worker protection must be strictly followed.

### **CADMIUM COMPLIANCE PROGRAM PROCEDURES**

This section describes the general procedures to reduce and control exposures to cadmium.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine if personal air monitoring is required. In some instances, the use of cadmium may not require air monitoring. Such an instance would be if cadmium is not heated to a degree where fumes would be generated.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Employee exposures to cadmium during brazing operations, during welding of cadmium-plated bolts, and during other minor tasks involving cadmium-containing products will be assessed. Tasks that require exposure assessments including personal monitoring shall be performed whenever a process that uses a regulated material changes or when a new task not previously assessed requires the use of a regulated material. All samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the exposure assessment reveals exposures are below the action level, no further monitoring needs to be conducted unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures are at or above the action level but below the TWA-8, air monitoring must be conducted annually.
- If the exposure assessment reveals exposures above the TWA-8, air monitoring must be conducted at least every six months.
- Exposure monitoring can be changed from every 6 months to annually after 2 consecutive measurements taken at least 7 days apart indicate the employee exposure is below the TWA-8 but above the action level. Exposure monitoring will only need to be reinstated to every 6 months then if a change has occurred in the process or control.
- Annual exposure monitoring can be stopped if 2 consecutive measurements taken at least 7 days apart are below the action level. Exposure monitoring will only need to be activated then if a change has occurred in the process or control.

#### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 15 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results, and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

#### Regulated Areas

Regulated areas will be established when initial exposure monitoring finds exposures to be above the TWA-8. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to cadmium fumes. Signs for the regulated area shall read "Caution, Cadmium, Cancer Hazard, Can Cause Lung and Kidney Disease, Authorized Personnel Only; Respirators May be Required in this Area".

Only authorized, properly trained individuals will be permitted to enter these areas. Eating, drinking, smoking, chewing tobacco or gum and applying cosmetics while performing a task involving cadmium or while in regulated areas is not permitted. Employees must wash their hands and face thoroughly upon completion of a task. Clothes worn while working with cadmium shall remain at the worksite and cannot leave the regulated area. Welding aprons and other waterproof equipment should be wet wiped at the end of a task.

Supervisors of the area are responsible for the posting the signs

Two regulated areas have been identified and established at GRC. Guidelines for each area may be found in the "Task Evaluations and Controls" section of this appendix.

#### Exposure Controls

##### Engineering Controls

Engineering controls may consist of various types of mechanical ventilation, substitution of cadmium-free alloys, or removal of cadmium-containing materials such as the stripping of cadmium-pigmented paints before brazing or welding activities. Whenever possible, substitution of cadmium-free alloys should be the first engineering control considered.

##### Respiratory Protection

The use of respiratory protection shall be in accordance with the GRC Respiratory Protection Program. All employees required to wear respirators for tasks involving cadmium shall be active in the program, have current medical approval, and have had their respirators quantitatively fit tested. Respirators shall only be used until effective engineering and work practice controls can reduce employee exposures to below the action level or whenever an employee requests a respirator. Respirators shall be worn at all times when work is performed outside of a regulated area such as in a test cell.

##### Protective Clothing

GRC shall provide to any employee exposed above the action level, regardless of respiratory protection, work clothing, and equipment that prevents contamination of the employee's garments. This includes uniforms or coveralls, gloves, disposable shoe covers, face shields, and goggles or safety glasses.

The protective clothing will be provided in a clean and dry condition on an as needed basis. Protective clothing shall be repaired or replaced as necessary.

All contaminated protective clothing shall be placed in a covered container properly labeled as "Cadmium Contaminated". The label shall indicate that laundering should be done in a manner that prevents the release of airborne cadmium. No employees or laundering personnel shall remove cadmium from clothing by blowing, shaking, or any other means, which disperses cadmium into the air.

#### Housekeeping

All surfaces shall be kept free of accumulations of cadmium or other dusts. Floors or other surfaces shall not be cleaned with compressed air. Wet wiping of areas or vacuuming with vacuums equipped with a high efficiency particulate air (HEPA) filter shall be performed at the completion of a task. Rags shall be disposed of properly in containers marked clearly "cadmium-containing, hazardous waste". Emptying of vacuums shall be in an appropriate manner to minimize reentry of cadmium dusts into the workplace.

Employees shall not consume food or beverages, use tobacco products or apply cosmetics in any areas where employees are exposed to cadmium above the action level without regard to respiratory protection.

#### Work Practices

Containers containing cadmium will be labeled "Danger, Contains Cadmium, Cancer Hazard, Avoid Creating Dust, Can Cause Lung and Kidney Disease".

#### Medical Surveillance

Air monitoring cannot adequately assess the amount of cadmium that will enter an employee's body. Therefore, a medical surveillance program has been established by to determine if employees may be showing the affects of cadmium exposure. Any employee, civil servant or contractor, who may have been exposed or who is currently being exposed to airborne levels of cadmium above the action level of 2.5 ug/m<sup>3</sup> (as an 8-hour time weighted average), as identified by the IHT will be included in the Medical Monitoring Program.

##### Biological Monitoring

Biological monitoring consists of testing an employee's blood and urine for cadmium levels and levels of Beta 2-microglobulin, a protein found in the urine.

Biological monitoring shall be scheduled and performed by Glenn Occupational Medical Services in accordance with the Cadmium Medical Monitoring Program.

##### Medical Examinations

Glenn Occupational Medical Services will provide complete medical examinations if results of the biological monitoring as outlined in the Cadmium Medical Monitoring Program indicate a need. Included in the medical examination will be a detailed medical and work history, a smoking history and current smoking status, complete physical examination, baseline chest x-ray, spirometry, additional biological monitoring tests, and any additional tests deemed appropriate by the examining physician.

#### Employee Training

All employees who are potentially exposed to cadmium at any level shall be informed of the contents of the cadmium standard. Training shall be conducted before assignment to an area above the action level. The training shall be repeated annually and shall include the following information:

- The health hazards associated with cadmium exposure.
- The content of 29 CFR 1910.1027 and appendices.
- The specific nature of the operations that could result in exposure to cadmium above the action level.
- The purpose, proper selection, fitting, use, and limitations of respirators.
- Engineering and work practices to reduce exposure
- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse effects associated with excessive exposure to cadmium.
- The contents of any compliance plan in effect.
- The employee's rights of access to records under 1910.20.

### Task Evaluation and Control

Cadmium tasks at GRC are restricted to brazing operations; new and reworking of old brazed materials, nickel-cadmium battery research miscellaneous laboratory research, and possible welding of cadmium-plated bolts and possible use of cadmium-pigmented paint.

#### Brazing Operations - Regulated Areas

Brazing operations performed in regulated areas will abide by the following guidelines:

Building 14, instrument shop, brazing fume hood

- All brazing shall be performed within the fume hood.
- Before brazing, the fume hood shall be checked for current validation tag and proper air flow.
- The hood shall be wet wiped upon completion of a task and the wipes disposed of properly.
- Employees shall follow proper hygiene practices.
- Items too large for the fume hood shall be taken to another regulated area. Brazing activities using cadmium shall be monitored by the IHT on an annual basis.

Building 50, shop, welding booth

- Respirators equipped with HEPA filters shall be worn whenever brazing with cadmium.
- A HEPA equipped air filtering system shall be acquired and used whenever brazing with cadmium.
- Protective clothing shall be worn. The area shall be wet wiped upon completion of a cadmium task and the wipes disposed of properly.
- Employees shall follow proper hygiene practices.
- Brazing activities utilizing cadmium shall be monitored by the IHT semi-annually or whenever necessary if more than six months has transpired since the previous brazing activity.

#### Brazing Operations – Non-regulated Areas

Brazing operations performed in non-regulated areas such as test cells will abide by the following guidelines:

- The IHT and supervisor must be contacted to obtain approval for the use of cadmium-containing brazes and notified of its intended use.
- The IHT must be contacted for task evaluation and possible monitoring for personnel exposures.
- Respirators, coveralls, and gloves must be worn.
- The area must be posted with signs indicating the use of cadmium and its hazards.
- All unnecessary personnel must vacate the area.
- A portable smog hog equipped with a HEPA filter will be used unless approval from the IHT has been granted to proceed without local ventilation.
- The entire area within a 5-ft radius must be wet-wiped upon completion of the task and the rags disposed of properly.

#### Nickel-Cadmium Batteries

Maintenance and servicing of the nickel-cadmium (Ni-Cd) batteries does not typically involve contact with the cadmium plates since batteries are not dismantled. Should standard procedures change, the IHT must be contacted for evaluation.

Initial exposure monitoring in the area of Ni-Cd battery research has determined that the exposures are below the action level during activities that included separating and reassembling the battery plates. The IHT must be contacted for assessment and to verify these results.

Exposure monitoring during the cutting of cadmium plates must be performed. The IHT must be contacted for assessment.

When handling the cadmium plates, employees will wear protective gloves and lab coats. The area will be wet wiped thoroughly before and after separation of plates and cutting of plates. Gloves and wipes will be disposed of as hazardous waste. Employees will follow proper hygiene practices.

#### Welding of Cadmium-Plated Bolts

Welding of cadmium-plated bolts will only be performed with approval and guidance from the IHT.

#### Research Use of Cadmium

Individual research tasks requiring the use of cadmium or its compounds shall be evaluated. The IHT must be contacted prior to the next scheduled use for evaluation and recommendations.

## REFERENCES

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1027 – Cadmium



## Appendix D – Formaldehyde

### BACKGROUND

Formaldehyde is highly irritating to the upper respiratory tract and eyes. Concentrations of 0.5 to 2.0 ppm may irritate the eyes, nose, and throat of some individuals. A concentration of 3 to 5 ppm causes tearing of the eyes and is intolerable to some persons. Concentrations of 10 to 20 ppm causes breathing difficulties, burning of the nose and throat, cough, and heavy tearing of the eyes. Concentrations of 25 to 30 ppm cause severe respiratory tract injury leading to pulmonary edema and pneumonitis.

Ingestion of formaldehyde causes severe irritation and inflammation of the mouth, throat and stomach. Severe stomach pains will follow with possible loss of consciousness.

Formaldehyde is a severe skin irritant and sensitizer. Contact causes white discoloration, drying, cracking, and scaling. Prolonged, repeated exposure can cause numbness and a hardening or tanning of the skin. Repeated exposures can also lead to allergic eczematous dermatitis or hives.

The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

The OSHA formaldehyde PEL-TWA is 0.75ppm and the PEL\_STEL is 2ppm. The AL is 0.5ppm for an 8 hour TWA. The NASA GRC OEL is a ceiling (C) concentration of 0.3 ppm. Compliance with these limits is primarily achieved through chemical substitution. When formaldehyde must be used, engineering and work practice controls combined with personal protective equipment are used to minimize exposures.

### FORMALDEHYDE COMPLIANCE PROGRAM PROCEDURES

This section describes the general procedures to reduce and control exposure to formaldehyde.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine employee exposure. In some instances, the use of formaldehyde may not require air monitoring. Such an instance would be if the formaldehyde were in a dilute solution that was not going to be aerosolized, it is used in a closed loop system, and all handling is performed within a properly operating exhaust hood.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Tasks that require exposure assessments including personal monitoring shall be performed whenever a process, requiring the use of a regulated material changes or when a new task, using a regulated material, has not been previously assessed.

All analyses of samples will be performed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the initial exposure assessment reveals exposures are below the action level, no further monitoring needs to be conducted unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures are at or above the action level but below the TWA-8, air monitoring must be conducted every 6 months.
- If the exposure assessment reveals exposures are at or above the STEL, air monitoring must be conducted annually.
- Exposure monitoring can be changed from every 6 months to annually after 2 consecutive measurements taken at least 7 days apart indicate the employee exposure is below the TWA-8 but above the action level. Exposure monitoring will only need to be reinstated to every 6 months then if a change has occurred in the process or control.

- Annual exposure monitoring can be stopped if 2 consecutive measurements taken at least 7 days apart are below the action level. Exposure monitoring will only need to be reinstated then if a change has occurred in the process or control.
- Monitoring shall be performed whenever leaks, spills, ruptures or other breakdowns occur that may lead to employee exposure. Monitoring will continue until exposures return to the level they existed prior to the incident.

#### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 15 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

#### Regulated Areas

Regulated areas will be established where exposure monitoring indicates exposures are above the TWA-8 or the STEL. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to formaldehyde. The signs for regulated areas shall read “Danger, Formaldehyde, Irritant and Potential Cancer Hazard, Authorized Personnel Only”.

Only authorized, properly trained individuals will be permitted to enter these areas. Supervisors of the area are responsible for posting signs.

#### Hygiene Facilities

Areas where solutions with a concentration greater than 0.1% formaldehyde are used must be equipped with approved safety showers and eye washes.

#### Exposure Controls

##### Engineering

Due to the hazardous nature of formaldehyde and the low permissible exposure level, all operations using formaldehyde shall be performed under local exhaust ventilation, unless the supervisor has granted prior approval of the task and the task has been evaluated and approved by the IHT.

##### Respiratory Protection

Respiratory protection shall only be used as an interim control or for emergencies. Respirators shall be used in accordance with the GRC Respiratory Protection Program.

##### Protective Clothing

GRC shall provide protective clothing that prevents contamination of the employee's garments and dermal contact to any employee who uses formaldehyde or formaldehyde containing products. This includes but is not limited to:

- work clothing such as aprons, lab coats and smocks
- equipment including appropriate gloves and safety glasses

All contaminated protective clothing shall be placed in a covered container.

#### Work Practices

Supervisors shall be responsible for ensuring that all employees follow good hygiene practices while performing tasks involving formaldehyde. This includes, but is not limited to, restricting use to regulated areas, disposing of rags properly, not eating, drinking, using tobacco products or applying cosmetics while performing a task, and washing thoroughly upon completion of a task.

#### Housekeeping

All leaks must be repaired quickly and all spills must be cleaned promptly by authorized employee wearing the appropriate clothing. Formaldehyde-containing waste and debris must be placed for disposal in sealed containers with the appropriate demarcation for formaldehyde. Labels for the container shall read “Danger, Formaldehyde Contaminated Material, Avoid Inhalation and Skin Contact”.

### Medical Surveillance

Medical surveillance is required when:

- An employee is exposed at or above the action level
- An employee is exposed above the STEL
- An employee develops signs and symptoms of over-exposure to formaldehyde
- An employee exposed in an emergency situation

The medical surveillance program will include initial examinations, annual examinations and emergency examinations. Multiple physician review will be available. Medical removal will be provided when warranted and medical removal protection will be honored in accordance with the OSHA Standard.

### Employee Training

All employees who use formaldehyde must receive training at the time of their initial assignment and annually thereafter for employees exposed to formaldehyde above the action level. Employees shall be informed of the contents of the Formaldehyde OSHA standard as well as this program. The training shall be conducted before assignment to a regulated area and annually thereafter. The training shall include the following:

- The content of 29 CFR 1910.1048 and appendices.
- The specific nature of the tasks that could result in dermal exposures or elevated airborne concentrations.
- The engineering controls and work practices associated with the specific job assignment.
- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects of formaldehyde.
- The proper use for and limitations of PPE
- Instructions for handling spills, clean-ups and emergencies
- The contents of this compliance plan.
- The employees' rights of access to records under 1910.20.

### REFERENCES

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1048 – Formaldehyde

## **Appendix E – Methylene Chloride**

### **BACKGROUND**

Methylene chloride is an anesthetic. Inhaling the vapor may cause mental confusion, light headedness, nausea, vomiting, and headache. Continued exposure may cause increased light headedness, staggering, unconsciousness, and even death. High vapor concentrations can cause irritation of the eyes and respiratory tract. Exposure to methylene chloride may make the symptoms of angina worse.

Skin exposure to methylene chloride may cause irritation. Skin exposure to liquid methylene chloride will cause skin burns. Splashes of methylene chloride into the eyes may cause irritation.

The best evidence that methylene chloride causes cancer is from laboratory studies where rats, mice, and hamsters inhaled methylene chloride 6 hours per day, 5 days per week for 2 years. Methylene chloride exposure produced lung and liver tumors in mice and mammary tumors in rats. No carcinogenic effects of methylene chloride were found in hamsters.

There are some human epidemiological studies, which show an association between occupational exposure to methylene chloride and increases in biliary cancer and a type of brain cancer. Other epidemiological studies have not observed a relationship between methylene chloride exposure and cancer. OSHA interprets these results to mean that there is suggestive ( but not absolute) evidence that methylene chloride is a human carcinogen.

The odor threshold for methylene chloride is found to be between 25 and 320 ppm. Studies have found that people can become adapted the odor of methylene chloride and lose the ability to detect it. Because the odor threshold is above the TWA, and people can develop odor fatigue, methylene chloride does not have adequate warning properties for exposure.

The OSHA PEL-TWA for methylene chloride is 25 ppm and the PEL-STEL is 125 ppm. The AL is 12.5 ppm for an 8 hour TWA. The NASA GRC OEL is the same. Compliance with this limit is achieved through chemical substitution. When methylene chloride must be used, engineering and work practice controls combined with personal protective equipment will be used to minimize exposures.

### **METHYLENE CHLORIDE COMPLIANCE PROGRAM PROCEDURES**

This section describes the general procedures to reduce and control exposure to methylene chloride.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine employee exposure. In some instances, the use of methylene chloride may not require air monitoring. For example, if methylene chloride were in a dilute solution that was not going to be aerosolized, is used in a closed loop system, or all handling is performed within a properly operating exhaust hood, air monitoring may not be necessary.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Tasks that require exposure assessments including personal monitoring shall be performed whenever a process, requiring the use of a regulated material, changes or a new task using regulated materials has not been previously assessed.

All analyses of samples will be performed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the initial exposure assessment reveals exposures are below the action level and at or below the STEL, no further monitoring is required unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures below the action level but above the STEL, air monitoring must be performed every 3 months.

- If the exposure assessment reveals exposures are at or above the action level, but at or below the STEL and TWA-8, air monitoring must be conducted every 6 months.
- If the exposure assessment reveals exposures at or above the action level and STEL, but at or below the TWA-8 air monitoring must be conducted every 3 months
- If the exposure monitoring reveals exposures above the TWA-8 but at or below the STEL, air monitoring must be conducted at the following schedule:
  - monitor TWA-8 every 3 months
  - monitor STEL every 3 months until the TWA-8 is achieved
- If the exposure monitoring reveals exposures above the TWA-8 and above the STEL, air monitoring must be conducted for TWA-8 and STEL every 3 months.
- Additional monitoring is required whenever a change in workplace conditions indicates that employee exposures may have increased.

Exposure monitoring can be stopped when 2 consecutive measurements taken at least 7 days apart are below the action level and the STEL.

#### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 15 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

#### Regulated Areas

Regulated areas will be established with exposure monitoring indicates exposures are above the TWA-8 or the STEL. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to methylene chloride. Signs for the regulated area shall read “Danger, Methylene Chloride, Potential Cancer Hazard, Authorized Personnel Only”.

Only authorized, properly trained individuals will be permitted to enter these areas. Supervisors of the area are responsible for the posting of the signs.

#### Hygiene Facilities

Approved safety showers and eye washes must be provided in areas where solutions containing greater than 0.1% methylene chloride are used.

#### Exposure Controls

##### Engineering

Due to the hazardous nature of methylene chloride and the low permissible exposure limit, all operations using methylene chloride shall be performed under local exhaust ventilation, unless the supervisor has granted prior approval of the task and the task has been evaluated and approved by the IHT.

##### Respiratory Protection

Respiratory protection shall only be used as an interim control or for emergencies. Respirators shall be used in accordance with the GRC Respiratory Protection Program.

##### Protective Clothing

GRC shall provide protective clothing that prevents contamination of the employee's garments and dermal contact to any employee using methylene chloride or methylene chloride containing products. This includes but is not limited to:

- work clothing such as aprons, lab coats and smocks
- equipment including appropriate gloves, face shields, and safety glasses

Employee rotation is not a permissible means of controlling exposures

#### Work Practices

Supervisors shall be responsible for ensuring that all employees follow good hygiene practices while performing tasks involving methylene chloride. This includes, but is not limited to, working only in regulated areas, disposing of rags properly, not eating, drinking, using tobacco products or applying cosmetics while performing a task, and washing thoroughly upon completion of a task.

### Housekeeping

All leaks must be repaired quickly and all spills must be cleaned promptly by authorized employees wearing the appropriate protective clothing. Methylene chloride-containing waste and debris must be placed for disposal in sealed containers with the appropriate demarcation for methylene chloride.

### Medical Surveillance

Medical surveillance is required when:

- An employee is exposed at or above the action level for 30 days or more a year
- An employee is exposed at or above the STEL for 10 or more days a year
- An employee is exposed above the TWA-8 for 10 or more days a year
- An employee is exposed above the TWA-8 or STEL regardless of frequency if a physician has identified them as being at risk from cardiac disease or from some other serious methylene chloride related health condition
- An employee developing signs and symptoms of over-exposure to methylene chloride
- An employee exposed in an emergency situation

The medical surveillance program will include initial examinations, annual examinations and emergency examinations. Multiple physician review will be available. Medical removal will be provided when warranted and medical removal protection will be honored in accordance with the OSHA Standard.

### Employee Training

All employees who use methylene chloride must receive training at the time of their initial assignment and annually thereafter for employees exposed to methylene chloride above the action level. Employees shall be informed of the contents of the methylene chloride OSHA standard as well as this program. The training shall be conducted before assignment to a regulated area and annually thereafter. The training shall include the following:

- The content of 29 CFR 1910.1052 and appendices.
- The specific nature of the tasks that could result in dermal exposures or elevated airborne concentrations.
- The engineering controls and work practices associated with the specific job assignment.
- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects of methylene chloride
- The proper use for and limitations of PPE
- Instructions for handling spills, clean-ups, and emergencies.
- The contents of this compliance plan.
- The employees' rights of access to records under 1910.20.

### **REFERENCES**

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1052 – Methylene chloride

## **Appendix F – Methylenedianiline (MDA)**

### **BACKGROUND**

Overexposure to methylenedianiline (MDA) produces fever, chills, loss of appetite, vomiting, and jaundice. Contact may irritate skin, eyes, and mucous membranes. Repeated, prolonged exposure to MDA, even at relatively low concentrations may cause cancer as well as damage to the liver, kidneys, blood, and spleen.

The OSHA PEL-TWA for methylenedianiline is 10 ppb and the PEL-STEL is 100 ppb.. The AL for methylenedianiline is 5 ppb for an 8 hour TWA. The NASA GRC OEL is the same. Compliance with this limit is primarily achieved through engineering and work practice controls combined with personal protective equipment.

### **METHYLENEDIANILINE COMPLIANCE PROGRAM PROCEDURES**

This section describes the general procedures to reduce and control exposure to MDA.

#### Exposure Monitoring

All regulated materials currently in use at GRC must have a hazard assessment performed by a member of the Industrial Hygiene Team (IHT) of EMO. This assessment shall be performed during the next scheduled use of the material. The user or area supervisor must contact the IHT prior to use and arrange for a member of the team to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Based on information from the hazard assessment, an exposure-monitoring program may need to be established to determine employee exposure. In some instances, the use of MDA may not require air monitoring. Such an instance would be if the MDA were in a dilute solution that was going to be used in a laboratory fume hood or it is used in a closed loop system, and all handling is performed within a properly operating exhaust hood.

In situations where exposure assessments are necessary, they will be conducted by an industrial hygienist in compliance with the OSHA standard guidelines. Tasks that require exposure assessments including personal monitoring shall be performed whenever a process that uses a regulated material changes or a new task not previously assessed requires the use of a regulated material. All samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

#### Frequency

- If the initial exposure assessment reveals exposures are below the action level and at or below the STEL, no further monitoring is required unless a change has occurred in the process or control.
- If the exposure assessment reveals exposures are at or above the action level, but at or below the TWA-8, air monitoring must be conducted every 6 months.
- If the exposure assessment reveals exposures above the TWA-8, air monitoring must be conducted every 3 months
- Exposure monitoring can be altered from every 3 months to every 6 months if 2 consecutive measurements taken at least 7 days apart are below the TWA-8 but above the action level
- Exposure monitoring can be stopped if 2 consecutive measurements taken at least 7 days apart are below the action level.
- Additional monitoring is required whenever a change in workplace conditions indicates that employee exposures may have increased.

#### Employee Notification

The IHT shall notify all affected parties of the results of exposure monitoring within 15 working days of receipt of results. The results shall be in the form of a written report detailing the sampling scheme, the results and the recommendations. The area supervisor shall post a copy of the results in a conspicuous place that is accessible to all employees. If the PEL is exceeded, the report shall address this and give a description of the corrective actions being taken to reduce employee exposure.

#### Regulated Areas

Regulated areas will be established when exposure monitoring indicates exposures are above the TWA-8 or where dermal exposures are likely to occur. These areas will be demarcated and segregated from the rest of the workplace to minimize the number of individuals exposed to MDA. Signs for the regulated area shall read “Danger, Methylenedianiline, May Cause Cancer, Liver Toxin, Authorized Personnel Only, Respirators and Protective Clothing May be Required to be Worn in this Area”.

Only authorized, properly trained individuals will be permitted to enter these areas. Supervisors of the area are responsible for the posting of the signs.

### Exposure Controls

#### Engineering

Due to the hazardous nature of MDA and the low permissible exposure level, all operations using MDA shall be performed under local exhaust ventilation, unless the supervisor has granted prior approval of the task and the task has been evaluated and approved by the IHT.

#### Respiratory Protection

Respiratory protection shall only be used as an interim control or for emergencies. Respirators shall be used in accordance with the GRC Respiratory Protection Program.

#### Protective Clothing

GRC shall provide protective clothing that prevents contamination of the employee's garments and dermal contact to any employee who uses MDA or MDA-containing products. This includes but is not limited to:

- work clothing such as aprons, lab coats and smocks
- equipment including appropriate gloves, face shields, and safety glasses

Employee rotation is not a permissible means of controlling employee exposures

### Work Practices

Supervisors shall be responsible for ensuring that all employees follow good hygiene practices while performing tasks involving MDA. This includes, but is not limited to, restricting use to regulated areas, disposing of rags properly, not eating, drinking, or applying cosmetics while performing a task, and washing thoroughly upon completion of a task.

All containers containing MDA will be labeled "Danger, Contains MDA, May Cause Cancer, Liver Toxin".

### Housekeeping

All leaks must be repaired quickly and all spills must be cleaned promptly by authorized employees wearing the appropriate protective clothing. Surfaces must be kept clean of visible MDA contamination. Contaminated surfaces may not be cleaned with the use of compressed air. MDA-containing waste and debris must be placed for disposal in sealed containers with the appropriate demarcation for MDA.

### Medical Surveillance

Medical surveillance is required when:

- An employee is exposed at or above the action level for 30 days or more a year
- An employee who is subject to dermal exposure 15 or more days a year
- An employee developing signs and symptoms of over-exposure to MDA
- An employee exposed in an emergency situation

The medical surveillance program will include initial examinations, annual examinations and emergency examinations. Multiple physician review will be available. Medical removal will be provided when warranted and medical removal protection will be honored in accordance with the OSHA Standard.

### Employee Training

All employees who use MDA must receive training at the time of their initial assignment and annually thereafter for employees exposed to MDA above the action level. Employees shall be informed of the contents of the MDA OSHA standard as well as this program. The training shall be conducted before assignment to a regulated area and annually thereafter. The training shall include the following:

- The content of 29 CFR 1910.1050 and appendices.
- The specific nature of the tasks that could result in dermal exposures or elevated airborne concentrations.
- The engineering controls and work practices associated with the specific job assignment.
- The purpose and a description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects of MDA.
- The proper use for and limitations of PPE
- Instructions for handling spills, clean-ups, and emergencies.



- The contents of this compliance plan.
- The employees' rights of access to records under 1910.20.

**REFERENCES**

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1050 – Methylenedianiline